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THE REMOVAL OF GARBAGE.

Prepared for Free Distribution by the North Carolina Board of Health.

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THE
REMOVAL OF GARBAGE.

PREPARED FOR FREE DISTRIBUTION

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NORTH CAROLINA BOARD OF HEALTH.

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THE DISPOSAL OF GARBAGE.*

The word garbage as used in this communication, means *house offal, ashes and dry house dirt, street sweepings, the contents of privy vaults and cess-pools, dead animals*, and all refuse which by accumulating is unsightly or noisome.

The disposal of garbage has received too little attention in most of our towns. The construction of sewers has developed some high skill in engineering, while the disposal of garbage is left to the street cleaner to do the best he can with the means provided him. It cannot be doubted, though, that the prompt and careful removal of garbage is a prime necessity in the conservation of the public health, or that its neglect or slovenly performance gives a bad reputation to a city, which is of course a damage to its commercial interests. We have an illustration of this in the recent demonstration in New York of the citizens of all classes, coming together in a public meeting to demand that the Street Commissioners should be held up to their duty in keeping the streets clean. Neglect of ordinary cleanliness of the streets, in the opinion of physicians and others, was a fruitful source of the increased sickness and mortality in the neglected quarters of the city. It is hardly necessary in this place to argue the necessity of the disposal of garbage.

In a very excellent article in the *Sanitarian* for July, 1881, Dr. O. W. Wight, the veteran sanitarian, of Milwaukee, speaks thus forcibly of the accumulation of human excreta:

*The substance of a paper read before the New Hanover County Board of Health in May, 1881.

"The privy vault should not be tolerated in any civilized neighborhood. Where there is no sewer system some form of earth closet ought to be used, and the contents frequently removed. The liquid portion of the excreta of horses and other domestic animals should be constantly removed by the sewer system. The solid portion should not be thrown upon the ground and bleached by the rain, but be kept under cover, dry, and frequently carted away. In fact, no organic matter should be thrown on the ground, nor deposited in the ground near human habitations. The soil where man dwells is sacred, and it is sanitary sacrilege to pollute it. He who fouls the air that he breathes himself, or the water that he drinks, or the food that he eats, is a barbarian who might learn wisdom from the cat, or decency from any swine not demoralized by contact with man. He who fouls the air that another must breathe, or the water that another must drink, or the food that another must eat, is a criminal, to be classed with those who maim and kill.

"There are more reasons for such care in the removal of organic wastes from inhabited places than appear on the surface. The chemistry and hygiene of putrefaction are complex, involving many practical considerations. Wherever there is a collection of putrefying organic matter, whether on the ground, in the ground, within a faulty sewer, or under a habitation, there is a tireless foe to health and life. Not only are putrescent collections of garbage, decaying vegetables, manure, offal, and human excreta harmful in themselves by reason of exhalations poisoning the air and leeching liquids polluting the earth; they are also depositories and multipliers of disease germs. Such collections may not produce infectious diseases *de novo*, but they lessen the vitality of people living in the neighborhood, and thereby lessen the power of resisting epidemics. It is a well-known pathological fact that nature struggles to eliminate disease by excretory processes. Accumulations of filth containing excreta may therefore harbor seeds of various communicable maladies. Sewer-gas, while it may not beget scarlatina, diphtheria, small-pox, and other contagious diseases, easily becomes the vehicle of conveying them, through obscure and intricate channels. Nor is this all. It is well known that a dung-heap will take cholera, hold it for an indefinite period, and convey it to human beings; that is, cholera dejecta thrown upon a dung-heap will plant in it the germs of the disease, there to take root and multiply,

and may communicate themselves to man under favoring circumstances. A privy vault will take typhoid fever, have it badly for a long time, and communicate the disease to human beings. It is probable that a heap of putrescent garbage may catch diphtheria in the same way, multiply its germs and communicate them to unsuspecting children. There is little doubt that every seething mass of organic matter is affected with yellow fever in the midst of an epidemic of that disease. It is believed by many experienced physicians that yellow fever is not communicated from person to person, but is always caught from surrounding objects.

"So great is the influence of filth in these various ways that no epidemic can make any serious headway in the midst of cleanliness. One frequented privy vault, down with typhoid fever, is more dangerous than a house full of human patients. A b g trunk full of dirty clothes, sick with yellow fever, is more to be shunned than a small hospital full of human victims of the disease. A village dunghill, planted with cholera, is more perilous than a dozen cholera corpses. A foul sewer, swarming with scarlatina germs, may be more dangerous to a neighborhood than an infected school-house."

The management of *household offal* will be first treated. This may be considered under three classes, viz: 1. The fragments of food, scraps, kitchen grease, moist solids or liquids known as *swill*. 2. Ashes, dry house and yard sweepings. 3. Night soil. In every well-managed household the first two should be kept in separate receptacles for convenient and economical disposal. The receptacle for swill should be a covered half-barrel, a pork barrel or any other water tight vessel. The receptacle for ashes should be in a place sufficiently removed from the dwelling or outhouses to avoid the chances of fire from carelessness of servants. The swill should be removed twice a week at least, and in the case of hotels, boarding houses or large families it should be done daily. The dry garbage, all denoted under the general term *ashes*, should be removed weekly from dwellings, and also from stores and factories.

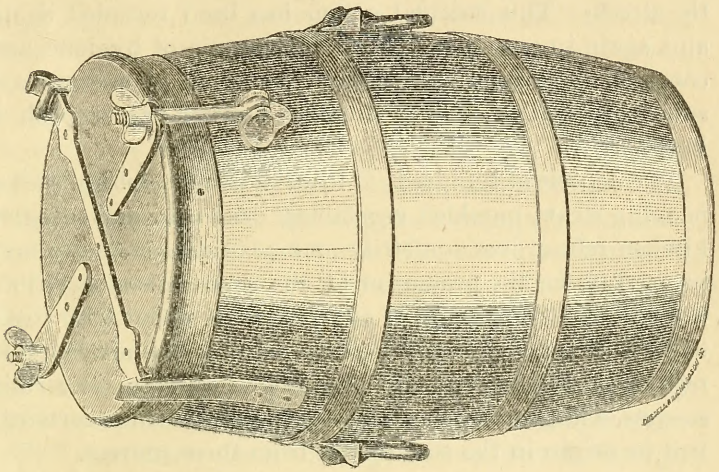
Before we come to the difficult question of the removal

of garbage, we will speak of the manner in which it should be cared for up to the time the garbage cart calls for it. No sweepings should be allowed to be thrown loosely into the streets, either from stores, houses or factories. Householders and proprietors should be required to keep their trash and ashes in boxes or barrels, as before mentioned. To allow violations of this simple rule, would be to abandon our streets at once, as they are now, to all sorts of litter. The indiscriminate deposit of dry trash now, in the streets, costs the corporation about one third of the time of the street hands in sweeping it together into piles; and because of insufficient force to carry it off or from negligence, the same piles are scattered to be again swept together or oftentimes allowed to remain and rot. This state of things would be bad enough if the dry trash alone was thrown into the streets. It is not infrequently the case that some dead domestic animal, or the entrails of fish and fowls are seen in the middle of the streets, offending the eye and disgusting the nose. The plan proposed therefore for the prompt removal of garbage, we suggest as follows:

The city should be divided into six sections, representing the six work-days of the week. This division should be accomplished with due reference to the density of the population in the different quarters of the city. Printed rules should be distributed giving the outlines of the sections, and notifying every householder, that on a certain day of the week regularly, their ash barrels and swill tubs would be taken away free of charge, but on no other days. The carts should visit every section in pairs—the one taking the *ashes*, &c., the other taking the swill. The household receptacles should be emptied and left. A suitable penalty for neglect of the regulations ought to be ordained after sufficient notification.

There need be no particular model for a cart for ashes, but for *swill* there is a barrel constructed by the Eagle Odorless Apparatus Company, 12 Pemberton Square, Boston,

four of which could be placed on a cart. The construction of this barrel is here figured:



Serious and careful attention should be paid to the selection of a dumping ground. For years it has been noticed that the sweepings and even disgusting offal have been removed from the thickly settled portion of the city, and dumped in huge piles around the suburbs. Not unfrequently helpless families on the outskirts have been made sick by the pestilential emanations which have been carried by the prevailing winds into their humble homes.

It is plain that this is grossly wrong and extravagant. Wrong, because the helpless petty tax-payer having no influential voice to abate the nuisance for him, is taken sick, and either suffers in consequence of being insufficiently cared for, or falls to the charge of the city, *consuming medicines, the cost of which should have been spent in preventing his sickness by making the surroundings of his home healthful;* extravagant for the reason above given, and also because the material which when wrongly disposed of engenders dis-

ease, if properly used upon a farm or garden would fertilize and improve it. But this is not the worst of it.

Garbage is used to fill in lots, and mend washed places in the streets. This suicidal action has been repeated again and again in our towns, until the lessons of hygiene and common sense have only taken possession of managers of some corporations, after pestilential disaster had brought it home.

The deposit of hundreds of loads of ashes, cabbage stalks, packing straw, moulded vegetables, dead cats, and mingled kitchen refuse does not strike one as being a wise sanitary proceeding for the present or for the future of streets or lots, but still all that portion of our city from about 10th street to 15th street, is largely upon a similar foundation, and notably in this part of our city, there has been, at certain seasons, a large amount of sickness, a part of which certainly had its origin in the emanations from these sources.

Now in the case of this city there is no reasonable excuse for the improper disposition of garbage. With a river front of two miles, we ought to be able to dispose of the daily accumulations which would not exceed thirty or forty cart loads, by means of scows, as is done in New Orleans. A dumping ground could easily be selected on the river at a safe distance from the city, one above and one below the city, in order to take advantage of the tides, at such points as directed by the Commissioners of Navigation.

If properly managed, arrangements might be made with farmers to take away *all the* garbage, including night soil, at a small cost. In some cities there is a competition between gardners to secure this garbage for their use at their own cost.

Swill is disposed of in Boston, and other cities, where a plan similar to the one we have outlined is adopted, to persons who use it to feed hogs, the city realizing thereby one-half of the total cost of collecting it.

We now come to a more difficult branch of our subject,—the disposal of night soil.

It is evident to every citizen who observes, that our privy arrangements are abominable. A few years ago, through the courtesy of my friend, the late Dr. Wright, who was then City Physician, I got a statement as to the condition and location of our privies, which by the way is a correct procedure in the thorough estimation of the scope and character of the evil to be dealt with.

Is there any remedy for this state of things? I answer, yes! There could easily be an improved condition of the privies at a cost so small, that any one owning a house, however poor, could afford to adopt it. But our case must be to remedy the evils as they are. The majority of privies have sinks. From time to time these sinks or vaults are emptied, to the intense disgust of the neighborhood where it is done. In some cases it is accomplished by excavating the privy contents and depositing them in a pit on the premises. In other cases carts are loaded up, and are driven through the streets, creating a horrid stench in their tracks. Now this can be remedied by adopting one of the many odorless plans. The one I show, is, I believe, the best of all. By means of it, a privy vault is entirely emptied, the contents conducted to stout bound casks, the inflammable gases being first burnt out to prevent bursting the casks, and thus prepared they can be taken through the streets without any odor arising.

DESCRIPTION OF THE APPARATUS FIGURED, FROM THE MANUFACTURERS.

THE AMES EAGLE ODORLESS EXCAVATING APPARATUS.

MANUFACTURED BY
THE EAGLE ODORLESS APPARATUS CO.
12 PEMBERTON SQUARE,
BOSTON.

The foregoing cut gives a faithful idea of the principal parts of the pumping-apparatus, a list of which is as follows:

A. The Pump.
B. Pump-receiver.
C. Suction-hose and connections.
D. Privy Sink.
E. Leading-hose and connections.
F. Barrels and fittings.
G. Air-hose and connections.
H. Furnace-deodorizer and connections.

The Pump, which weighs complete three hundred and thirty pounds, is a neat, cast-iron, brass-lined, double-acting machine, on wheels, which render its movements from place to place exceedingly easy.

It is designed with a view to making all its parts instantly and easily accessible, a point never before accomplished in any similar apparatus. All four of its valves are of rubber, are outside the pump, and can be examined or replaced in five minutes, and its cylinder-heads removed in the same time. Its operation is such as to give the largest return for the power employed. As it passes only air and gases through it, it never clogs, is kept clean, and does not wear.

As it must be air-tight in all its connections and parts, it cannot leak gas or odor, and hence is its own guaranty against that leakage and drip which are inseparable from pumps whose traveling-rods are constantly wearing.

The hose and handles are instantly detachable; and it is very compact, occupying an area only three feet and six inches long by twenty inches wide. One man moves it easily; two lift it readily; and two, or at most three, operate it with ease.

The whole effort of the pump is:—

First, to create the most complete vacuum possible in the pump-receiver, and force the exhausted foul air through the furnace-fire; and

Second, to compress air as powerfully as possible upon the contents in the pump-receiver, and expel them through the leading-hose into the barrels or tank upon the wagon.

Upon the completeness and extent of the vacuum created, depends the power of this or any other pumping apparatus.

The Pump Receiver, which is, in effect, a second cylinder or chamber of the pump, is the prime element of novelty in the combination. It consists of a strong forty-five gallon oak barrel, thoroughly made, hooped with galvanized iron, and having peculiar fittings for its service. These are two brass gates, or valves, one attached to one side of the receiver close to the top, and the other to the opposite side close to the bottom. To the upper one the suction-hose connecting the receiver with the vault is coupled, and to the lower the hose leading to the wagon.

Galvanized iron handles are attached to the receiver, one on each side, so that it is easily and neatly carried (even through the finest dwelling) from the wagon to the vault and back.

To the head of the receiver a brass coupling-spud is attached, through which the cork float-valve is inserted, and to which the air-hose is coupled when the apparatus is in use, a covering-cap being fitted securely to it when not in service. The insertion of an air-tap outside the valve, and between it and the coupling in the upper gate, enables the reflex use of atmospheric pressure to clear the suction-hose in case it should clog. The whole or any part of the power of the pump may be applied by a special coupling to this little tap to force out anything in the suction-hose.

The Suction Hose, used with this apparatus, is of rubber, usually made in lengths of 10 and 15 feet, and has an inside diameter of three inches; it is lined

with spiral galvanized flat iron or brass wire to prevent collapse; is of the best quality, and weighs three pounds to the running foot. The couplings are all of brass, simple and instant in action, and are "male" and "female," or "swivel" and "plain."

The swivel has a revolving disk pivoted at the centre, with a rubber gasket glued to its face.

The style of coupling is the same throughout the apparptus. A "swivel" sealing-cap closes each "plain" hose-end, and a sealing-plate fits into and closes the "swivel" end of each length of hose when not in use.

The Leading Hose, also of rubber, is also of three-inch inner diameter, but without the iron or brass lining.

The Air Hose, used in making the pump-connections, is also of rubber, and is in two pieces or length, one of ten and the other of five feet. The ten-foot length is wire-lined suction-hose of one inch calibre. At one end it has the cork-float-valve (protected, when not in use, by a brass cap which encloses it, and couples by its rim, to the "swivel" of the valve); and around the neck of this valve is the "swivel" coupling, which secures it air-tight to the top spud of the pump-receiver.

The Wagon Barrels, (used only with the pumping apparatus) are strong, forty-five gallon oak barrels, and are not peculiar except in their fittings. These consist of two coupling-spuds with their sealing-caps, which are made upon the same principle as the hose couplings. The larger (iron) spud is for the attachment of the valved goose-neck at the end of the leading hose, and through it the barrel is both filled and emptied. The smaller one is of brass, and is for the air-hose connection. The caps in each are provided with "swivel" disks and rubber gaskets, which effect air-tight joints in sealing.

The barrels have these advantages:—

They are light and cheap, and perfectly air and water tight.

They do not require a long time for construction, &c., but are procurable in any place (common forty-five gallon oil barrels are the thing); and any carpenter can attach the fittings to either in a few minutes.

They are easily and cheaply multiplied, but it entails large expense to multiply tanks.

They rarely leak, and are quickly cleansed inside and out with a hose, cost little to repair or renew, and as many or as few as are needed (so regulating the load) can be taken on the wagon.

They can, if occasion requires, be taken from the wagon to fill or empty; a convenience sometimes found of great value, as in cellars at a great distance from streets, or when dumping in very miry places.

The Deodorizing Furnaces, are of galvanized iron, with cast-iron grates and fire-clay linings. They are fitted with a hook by which to suspend them to the wagon while in transit, a bail by which to carry them, a draught-door beneath the grate, a removable top of conical shape which is prolonged into a short chimney having a damper, and a short throat-tube at the side, to receive the air-hose from the pump.

The gases and foul vapors are doubly provided for: first, by being withdrawn by the pump, and burned by its furnace; and, second, by passing into a second furnace from the final receptacle, thus providing absolutely against danger or offense.

The necessary machinery costs about $600. It could be easily paid for by fees arising from the service of it. A committee could easily enquire into the practicability of it.

I would suggest that it be purchased by the corporation and rented to reliable persons. The inducement would be to the person renting it that he could make it profitable by fees collected, and by the disposal of the night soil as a fertilizer. These are all practical questions, and as sanitarians we must look them squarely in the face. The air of this town reeks with the dense stinks from its hundreds of privies nightly, from August to October especially, and it could be made pure and sweet by the proper effort.

There are privies other than those spoken of, and for their remedy it would be necessary to send a cart with lime and copperas from door to door to disinfect them.

I have selected this subject for your consideration to-night, because it has given us all, at one time or other, much concern. It is not a pleasant thing to talk about, but its bearing upon the health of this community is material. We cannot assume the sanitary responsibility of our people without taking the lead in works of reform. I trust the city will take matter in hand at an early day, so that a system may be thoroughly organized before the hot weather is fairly upon us.

The foregoing paper was presented to the New Hanover County Board of Health, and by resolution it was submitted to the Mayor and Board of Alderman of the city of Wilmington, for their consideration.

It must not be wrongly inferred that because the first effort to systematize the disposal of garbage began in Wilmington, that it is most needed there. There is hardly a community in the State to which the general principles here laid down do not apply. The smaller towns are sometimes the most neglected.

A sanitary survey of a town, if carefully and conscientiously conducted, would astonish those who have heretofore considered their town a clean one, and this applies to most of our towns and cities. It will be useless to expect any improvement in those communities not convinced of

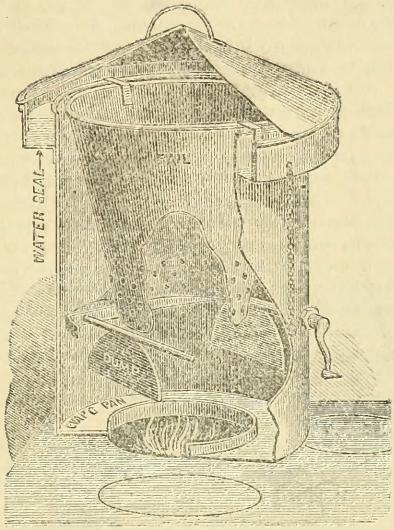
their uncleanliness. The authorities in towns and cities move very slowly in the direction of improvements, and when they do, it is to follow obsolete plans. It has been common in many places, indeed it is now common, when the very best has been done in the way of cleaning streets and alleys, for the result to be only a make-ready-for-inspection attempt, with all the clean things in sight, and the harmful, dangerous things merely hid away and covered over with disinfectants. Disinfectants are made to displace the cleansing processes, and many people are lulled into a false security. Not only so, but being satisfied with a work well done, all efforts subside until the work can be no longer put off, and then is repeated the same perfunctory attempts at cleansing.

It is just this state of things that in New Orleans gave birth to that most useful body, known all over this great country for their faithful sanitary work, the New Orleans Auxiliary Sanitary Association. The example of New Orleans might be followed with profit in every city. The aid possible to be rendered to cities in the interests of cleanliness is very great by similar organizations. It is possible for auxiliary sanitary associations to work harmoniously with the regular health boards without any jarring, and the amount of emulation excited by the two bodies working earnestly to carry out the same thing, can be readily conceived.

If, therefore, the citizens of towns, villages, and cities, will show that they are awake to the necessities of a thorough sanitary police, by taking the initiative first on their own premises, then in the streets nearest them, the needed reform cannot be long delayed.

It will interest many householders doubtly to know of all the plans for the disposal of garbage. One of the very best methods is to burn it. The following account is taken from the *Manufacturer and Builder*:

How to dispose of Kitchen Garbage.—The disposal of kitchen garbage is one of the standing annoyances to the cleanly house-keeper. In the country, or



in the suburbs of our cities and towns, where the pig-pen is conveniently at hand, no trouble is experienced in ridding the premises of this form of refuse; but in the cities and towns the best regulated efforts for its removal are but indifferently successful, and in the summer season especially, when the attempt is made to save it, it speedily undergoes decomposition and becomes a putrid, offensive and unwholesome nuisance, an abomination to the nostrils, and a menace to the health of those who are forced to inhale its disgusting emanations. To avoid this constant and often intolerable nuisance, many intelligent housekeepers adopt the sensible course of burning it in the kitchen range as fast as it accumulates. Where this is done properly the method is effective and inoffensive, the gases and vapors evolved during the burning of the refuse being carried off with the other combustion products by the chimney, harmless and unperceived. There are some practical objections, however, to the plan of burning the refuse of the kitchen directly in contact with the fire, which are due chiefly to the fact that the stuff, composed largely of the parings and other rejected portions of vegetables, bones and other animal refuse, is largely charged with moisture. This water must first be driven off before the refuse will commence to burn, and this takes considerable time, or demands that the garbage shall be thrown in in small quantities at a time, which implies personal care and attention to the operation. The proper way to effect the burning of kitchen garbage, is manifestly first to thoroughly desicate it and to throw the dried material into the fire where it will be immediately consumed.

A very practical and excellent household apparatus for disposing of kitchen garbage upon this plan is shown in the accompanying engraving, and will be understood from the following description: It consists of a pail for the reception of the garbage, provided with a set of perforations, and with a dumping bottom which can be closed to hold the charge or opened to dump it when dried, by turning the crank seen in the cut. This garbage pail is suspended within an outer cylinder having a circular opening in its base, so that it may fit over one of the openings of the range, and a close cover whose edge dips into a water-seal. To use this apparatus, it is placed over one of the openings of the range. The dumping bottom of the pail is closed by raising the crank and putting the ring over the handle, the garbage is emptied into the pail, the water-seal filled, and the cover put on. After half an hour or so, more or less, according to the nature and quantity of the garbage and the heat of the range, the contents of the pail will be found to be thoroughly dried, and may be dumped into the fire and burned by releasing the crank handle from the ring. During the drying of the charge all the disengaged vapors are either condensed in the water seal, or dissipated with the vapor from the evaporating pan. By the peculiar construction of the apparatus, the contents of the pail are hermetically sealed within it, and none

of the vapors find their way out of it; consequently no unpleasant odors are given off during the operation. The dessicated garbage is immediately burned as it is dumped into the fire, and the whole operation is effected simply, expeditiously and with no disagreeable accompaniments.

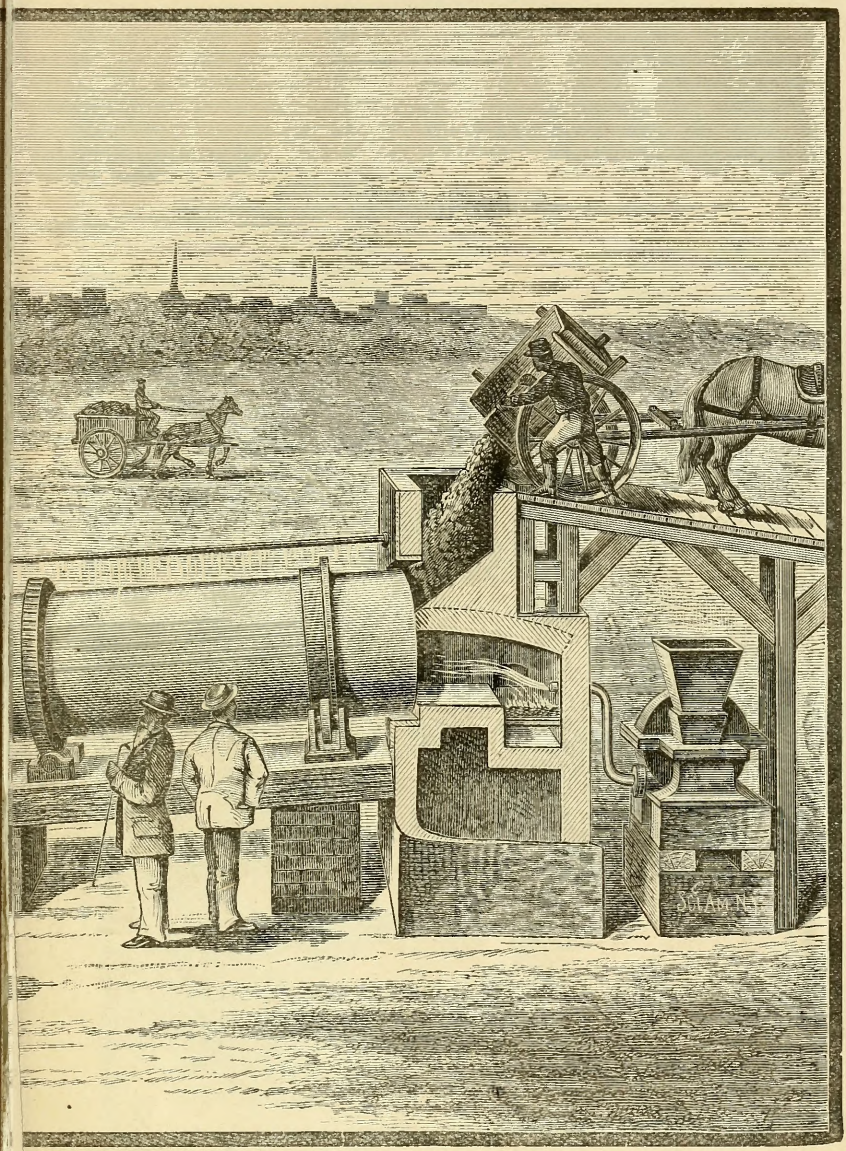
The method and apparatus here described is worthy of the highest recommendation, not only because of its convenience and cleanliness, but also on the much more important ground of sanitary considerations. No intelligent housekeeper requires to be told that the foul emanations from the putrefying garbage receptacles, which no amount of cleansing will suffice to keep clean, are in addition to their extreme offensiveness, also in the highest degree unwholesome, in that they can become the carrier of the germs of pestilential fevers, which are most insidious in their approach and very frequently fatal in their results. To unwholesome influences of this kind the children of the household, by reason of their superior sensitiveness, and women, for the reason of their domestic habits, keep them constantly exposed to their effects, are especially susceptible. We highly approve of the method and apparatus here described for disposing of kitchen garbage, as affording a simple, efficient and expeditious means of doing away with an offensive and unwholesome domestic nuisance

The apparatus is manufactured and for sale at Myers' Sanitary Depot, 91 Beekman street, New York.

Directions for Use.—Set the burners on the range, close damper by raising crank and putting ring over handle, put garbage in pail, fill the water-seal and put on the lid. After half an hour or so, according to the nature of the garbage and the amount of heat, the contents will be dried and may be dumped into the fire and burned by releasing the crank handle from the ring. Meanwhile all vapors have been condensed in the water-seal and dissipated with the water in the evaporating pan, no odor escaping.

On a larger scale the garbage of the city of New York is to be disposed of by burning in a STORER'S GARBAGE CREMATING FURNACE. We get our information and our illustration from the *Scientific American* of July 2d, 1881. About 750,000 tons of garbage were collected there the last year. This mass now burned to ashes in the furnace here represented, will yield a large amount of ashes, suitable for filling streets and lots. [*See large plate.*]

The "furnace consists of a brick-lined cylinder, 60 feet long or thereabouts, and 6 feet in diameter, set at an inclination of about half an inch to the foot, on anti-friction rollers, and revolved by worm and wheel. At the feed end of the cylinder is a small fire-place that is used only for the ignition of the pulverized fuel, which is the principal agent in this work, and for which the inventor of this furnace holds the only United States patents. At the delivery end of the cylinder is shown a receiving chamber or pit (the parts be-



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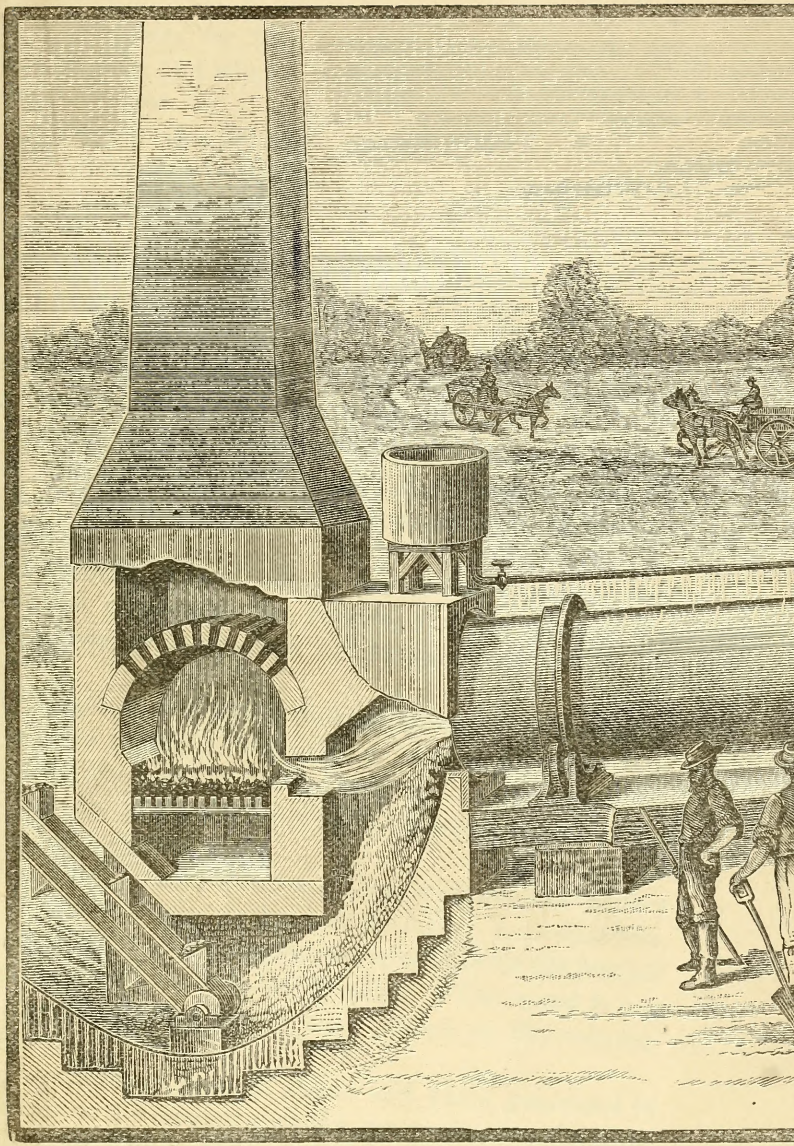

STORER'S GARBAGE C

ing broken away for this purpose), into which the dried material falls, and whence it is continuously removed by a bucket elevator.

Just beyond this pit, in the base of the smoke stack, is the gas mingling and combustion chamber, in which the escaping steam and gases are decomposed and thereby rendered inoffensive.

The operation of the furnace is as follows: The fire is urged in the first fire place until the latter is hot enough to instantly ignite the pulverized coal which is injected through it by the pulverizer or fan, as shown in the engraving. The jet of burning pulverized coal entering the cylinder quickly heats it throughout to a white heat. At the same time the fire on the grate in the gas combustion chamber has brought the walls and perforated dome thereof to a white heat.

The cylinder is then put in motion at the rate of from two to ten revolutions per minute, and the garbage and ashes, separately or together, are dumped into it from the carts.

The material, as it passes through the cylinder, is exposed to the direct contact of the intense flame and to the direct radiation from the hot brick lining of the cylinder for as long a period as may be desired, this depending upon the speed of the cylinder.

At a speed of about five revolutions a minute the furnace will dry the garbage to the best condition for a fertilizer, while at a speed of two revolutions a minute for the furnace the garbage will be reduced to ashes. The speed is regulated at will by the use of cone pulleys on the countershafts.

The enormous volume of steam and gases generated in the process move forward into the gas combustion chamber, and are there decomposed and burned, the perforated dome retaining them sufficiently long for this purpose.

There escapes then, through the dome an intense white

flame of sufficient volume to generate steam for all the purposes of the work; not the slightest offensive odor escaping.

A drip pipe discharges a constant spray of water on the cylinder to prevent the expansion thereof, so that the brick lining shall not become loose.

The illustration shows the smokestack constructed of brick above the gas consuming chamber; this construction is preferable for furnaces erected on land; but for those on barges an iron stack is better.

One cylinder, 60 feet long and 6 feet in diameter, will reduce to ashes each day the daily production of garbage in New York, or over 250 loads per diem, and the cost of it, complete with all its auxiliary parts and the engine to run it, will not exceed $12,000.

THE VALUE OF NIGHT-SOIL.

From a German work, on "The Employment of Human Excreta and Animal Remains in Agriculture," by Wilhelm Hahn, we extract the following statement of the value to the farmer of a manure that is now almost entirely wasted in every part of our country. According to these tables, the human excrement of our population of 40,000,000 is equal, in respect to its nitrogen, to *one hundred million tons of cattle-dung*. This is a statement that needs no comment. We recommend it to the careful consideration of all who care for the problems of national prosperity.

Inquiry has shown that a grown person produces daily 2 lbs. of fæces, of which 1½ lb. is fluid and ½ lb. solid.

In every 100 lbs. of urine there are 4 5-6 lbs. nitrogenous matter, in the proportion of 100: 46¾; so that in 100 lbs. of urine we have about 2¼ lbs. nitrogen.

In 100 lbs. of solid fæces we have 4 1-10 lbs. nitrogen, so that in the yearly product of a grown person (547 lbs. fluid and 183 lbs. solid fæces) we have:—

In the fluid.....12½ lbs. nitrogen.
" solid..... 7½ lbs. "

Or.....19 5-6 lbs nitrogen per annum.

Or in 100 lbs. of the mixed fæces we have 2¾ lbs. nitrogen.

So that, in respect to nitrogen, 100 lbs. mixed human fæces are equal to:

417¾ lbs. horse-dung.	753⅓ lbs. cattle-dung.
445 1-5 lbs. pig-dung.	298½ lbs. sheep-dung.

As compared with the best guano, which contains 13 per cent. of nitrogen, the yearly product of a grown person would equal 1½ cwt. of the latter, as regards nitrogen, or 100 lbs. of mixed fæces would equal 34½ lbs. of best guano.

In respect to alkalies, 100 lbs. human fæces equal:

109 lbs. horse-dung.	111 lbs. cow-dung.
112 lbs. pig-dung.	51 lbs. sheep-dung.

In respect to phosphates, 100 lbs. human fæces equal:

208 lbs. horse-dung.	415 lbs. cow-dung.
208 lbs. pig-dung.	124 lbs. sheep-dung.

In comparing human fæces with that of animals, it would be well to take into consideration the fact that quantities of straw, &c., are mixed therewith. A comparison of human fæces with stable-manure will show that 100 lbs. of the former are equal is respect to nitrogen to:

550 lbs. horse-stable manure.	753 lbs. cow-stable manure.
560 lbs. pig "	400 lbs. sheep "

In respect to alkalies, to:

135 lbs. horse-stable manure.	140 lbs. cow-stable manure.
142 lbs. pig "	75 lbs. sheep "

Or, in respect to phosphoric acid, to:

320 lbs. horse-stable manure.	500 lbs. cow-stable manure.
330 lbs. pig "	250 lbs. sheep "

As the best guano contains about 12 per cent. alkali salts, and an equal quantity of phosphoric acid, 100 lbs. mixed fæces will equal 8 lbs. guano in respect to alkalies, and 5⅔ lbs. in respect to phosphoric acid.

"If," says Professor Liebig, "we admit that the liquid and solid excrements of man amount on an average to 1½ lb. daily (5-4 lb. of urine and ¼ lb. fæces), and that both together contain 3 per cent. of nitrogen, then in one year they will amount to 547 lbs., which contains 16 41-100 lbs. of nitrogen,—a quantity sufficient to yield the nitrogen of 800 lbs. of wheat, rye, oats, or of 900 lbs. of barley." (*Boussingault's Analysis.*) "This much more than is necessary to add to an acre of land in order to obtain, with the assistance of the nitrogen absorbed from the atmosphere, the richest possible crop every year Every town and farm might thus supply itself with the manure, which, besides containing the most nitrogen, contains also the most phosphates; and, if rotation of the crops were adopted, they would be most abundant."

"Night-soil," says Gregory, the successful seedsman and farmer of Marblehead, Mass., "used in compost with muck or soil, stable-manure, sea-manure, &c., is good for *all* crops."

Joseph Harris, in his valuable "Talks on Manures," says, "The composition of human excrements, as compared with the mean composition of the excrements from horses, cows, sheep, and swine, so far as the nitrogen, phosphoric acid, and potash are concerned, is as follows:—

Table showing the Amount of Nitrogen, Phosphoric Acid, and Potash in One Ton of Fresh Human Excrements, and in One Ton of Fresh Excrements from Horses, Cows, Sheep, and Swine.

One Ton (2,000 lbs.).	Solids.			Urine.		
	Nitrogen.	Phosphoric Acid.	Potash.	Nitrogen.	Phosphoric Acid.	Potash.
Human	20.0 lbs.	21.8 lbs.	5.0 lbs.	12.0 lbs.	3.7 lbs.	4.0 lbs.
Mean of Horse, Cow, Sheep, and Swine	9.4 lbs.	6.2 lbs.	4.3 lbs.	22.5 lbs.	0 4 lbs.	25.4 lbs.

"One ton of fresh fæces contains more than twice as much nitrogen, and more than three times as much phosphoric acid, as a ton of fresh-mixed animal dung. The nitrogen, too, is probably in a more available condition than that in common barnyard-dung; and we should not be far wrong in estimating 1 ton of fæces equal to 2½ tons of ordinary dung, or about equal in value to carefully preserved manure from liberally-fed sheep, swine, and fattening cattle. . . . It has been ascertained by Lawes and Gilbert that the amount of matter voided by an adult male in the course of a year is: fæces, 95 lbs.; urine, 1,049; totally liquid and solid excrements in the pure state, 1,144 lbs. These contain:—

"Dry substance.—Fæces, 23.75 lbs.; urine, 34.50 lbs.; total, 58.25 lbs.

"Mineral matter.—Fæces, 2.50 lbs.; urine, 12 lbs.; total, 14.50 lbs.

"Carbon.—Fæces, 10 lbs.; urine, 12 lbs.; total, 22 lbs.

"Nitrogen.—Fæces, 1.2 lbs.; urine, 10 8 lbs.; total, 12 lbs.

"Phosphoric acid.—Fæces, 0.7 lbs.; urine, 1.93 lbs.; total, 2.63 lbs.

"Potash.—Fæces, 0.24 lbs.; urine, 2.01 lbs.; total, 2.25 lbs.

"The amount of potash is given by Professor E. Wolff, not by Lawes and Gilbert.

"The mixed solid and liquid excrements, in the condition they leave the body, contain about 95 per cent of water. It would require, therefore, 20 tons of fresh-mixed excrements to make a ton of *dry* night-soil, or the entire amount voided by a mixed family of forty-three persons in a year.

"100 lbs. of fresh fæces contain 75 lbs. of water and 25 lbs. of dry substance.

"100 lbs. of fresh urine contain 96.50 lbs. of water and 3 50 lbs. of dry substance.

"100 lbs. of dry substance of the fæces contain 5 lbs. c nitrogen and 5.50 lbs. of phosphates.

"100 lbs. of the dry substance of the urine contain 27 lbs. of nitrogen and 10.75 lbs. of phosphates.

"These figures are from Lawes and Gilbert, and may be taken as representing the composition of excrements from moderately well fed persons.

"According to Wolff, a ton of fresh human urine contains 12 lbs. of nitrogen; according to Lawes and Gilbert, 18 lbs. . . .

"The value of a ton of fresh fæces on the land is $4.09."—*Pamphlet of Ames Eagle Odorless Company.*